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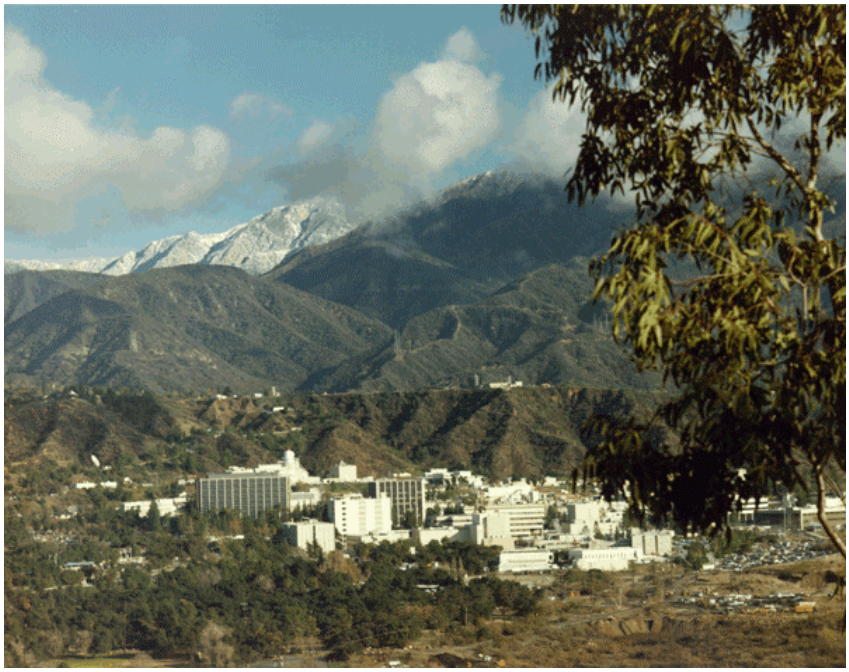
# FINAL

# RECORD OF DECISION AND REMEDIAL ACTION PLAN FOR OPERABLE UNIT 2

## NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
## JET PROPULSION LABORATORY
## PASADENA, CALIFORNIA

**EPA ID# CA9800013030**



**PREPARED FOR:**

**National Aeronautics and Space Administration**
**Management Office, Jet Propulsion Laboratory**
**4800 Oak Grove Drive**
**Pasadena, California 91101**

**September 2002**

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**Pasadena, California 91101**

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**September 2002**

# Part I: DECLARATION FOR THE RECORD OF DECISION

## Site Name and Location

| | |
|---|---|
| SITE NAME: | Jet Propulsion Laboratory (JPL) |
| EPA ID NUMBER: | CA9800013030; Federal Facility Agreement Docket Number 1998-27 |
| LOCATION: | 4800 Oak Grove, Pasadena, California |
| SITE TYPE: | Federal facility; Government owned, contractor operated |
| LEAD AGENCY: | National Aeronautics and Space Administration (NASA) |
| SUPPORTING AGENCIES: | U.S. Environmental Protection Agency (EPA), Region IX; State of California Environmental Protection Agency (Cal-EPA), Department of Toxic Substances Control (DTSC); and California Regional Water Quality Control Board (RWQCB), Los Angeles Region |
| OPERABLE UNIT: | Operable Unit 2 (OU-2), on-facility vadose zone soil |

## Statement of Basis and Purpose

This document is published as a Record of Decision (ROD) under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), 42 United States Code (USC) § 9601 et seq., and as a Remedial Action Plan (RAP) under the California Health and Safety Code (HSC), § 25356.1. This decision document presents the remedy selected by NASA and the supporting agencies (EPA, DTSC, and RWQCB) for OU-2 at JPL. The remedy was selected in accordance with CERCLA, as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR 300.400 et seq. and HSC § 25356.1. The remedy was selected based upon information in the Administrative Record for OU-2.

## Assessment of the Site

The remedy selected in this ROD is necessary to protect human health and the environment from actual or threatened releases of hazardous substances into the environment.

## Description of the Selected Remedy

In October 1992, JPL was placed on the National Priorities List (NPL) and, therefore, is subject to the provisions of CERCLA. The JPL site has been divided into 3 OUs. OU-1 is on-facility groundwater at JPL; OU-2 is on-facility vadose zone soil at JPL; and OU-3 is off-facility groundwater adjacent to the JPL property. This decision document addresses OU-2, on-facility vadose zone soil at JPL. The remedy alternatives for OU-1 and OU-3 are being developed separately and will be presented to the public at a later date.

A human health risk assessment (HHRA) and an ecological risk assessment (ERA) were conducted based on the analytical results from soil and soil vapor samples collected during site investigation activities at OU-2. The HHRA and ERA indicated that chemicals present in near-surface soils (<30 below ground surface [bgs]) at JPL do not pose an unacceptable risk to humans or to plant and animal life (FWEC, 1999a). However, volatile organic compounds (VOCs) were detected at elevated concentrations in soil vapor samples collected beneath JPL at depths extending to the water table, and could migrate to groundwater.

The remedial strategy is to use soil vapor extraction (SVE) technology to remove VOCs from the vadose zone. This process will improve the effectiveness and efficiency of the groundwater remedy for OU-1 and OU-3 by reducing chemical mass entering the groundwater.

SVE is a two-step process. In the first step, VOCs in soil vapor are removed from the subsurface by applying a vacuum to an underground well. In the second step, the recovered vapors are filtered out by carbon (or some other treatment process) to prevent their release to the atmosphere. The major components of the selected remedy are as follows:

- Use SVE to remediate VOCs in vadose zone soil.
- Conduct periodic soil vapor sampling to monitor system performance.

The implementation of SVE at OU-2 is protective of human health and the environment and complies with applicable or relevant and appropriate requirements (ARARs). In addition, the EPA has designated SVE as a presumptive remedy for VOCs in soil based on an extensive analysis of technical literature and the results of the remedy selection process at other CERCLA sites (EPA, 1993). The EPA's evaluation concluded that SVE was the preferred remedial approach under most circumstances at sites similar to JPL. NASA's and the supporting agencies' determination to apply SVE to remediate VOCs in soil at OU-2 is supported by the results of a pilot test conducted during the Feasibility Study (FS) (FWEC, 2000).

## Remedial Action Plan

The California HSC, Section 25356.1 RAP requirements have been incorporated into the ROD to fulfill state requirements. A copy of the California HSC Section 25356.1 is included as Appendix A.

## Statutory Determinations

The selected remedy is protective of human health and the environment, complies with federal and state ARARs, is cost-effective, and utilizes permanent and alternative treatment technologies to the maximum extent practicable. The remedy also satisfies the statutory preference for treatment as a principal element of the remedy (i.e., reduces the toxicity, mobility, or volume of hazardous substances through treatment).

NASA intends to remediate VOCs in vadose zone soil at JPL to prevent, to the extent practicable, further migration of VOCs to groundwater. A Five-Year review will be conducted if hazardous substances, pollutants, or chemicals remain at the site above levels that allow for unlimited use and unrestricted exposure. This site and remedy review will be conducted no later than five years after the start of the remedial action (See, 42 USC 9621(c)).

## ROD Data Certification Checklist

The following information is included in Part II: Decision Summary of this ROD. Additional information can be found in the Administrative Record.

- Chemicals and their concentrations in vadose zone soil, Section 5.0.
- Baseline risk represented by the chemicals in vadose zone soil, Section 7.0
- Cleanup levels for the chemicals in vadose zone soil, Sections 8.0 and 11.0
- How chemicals in vadose zone soil will be addressed, Section 11.0
- Current and reasonably anticipated future land use assumptions, Section 6.0
- Current and potential future beneficial uses of groundwater, Section 6.0
- Potential land and groundwater use that will be available as a result of SVE, Section 11.0
- Estimated capital, annual operation and maintenance (O&M) and total present worth costs for SVE, Section 11.0
- Number of years that SVE is expected to operate, Sections 9.0 and 11.0
- Key factors that lead to selecting SVE, Sections 9.0, 10.0, 11.0, and 12.0.

**FOR THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, JET PROPULSION LABORATORY:**

Robert Parker, Director
NASA Management Office
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9/23/02
Date

**FOR THE U.S. ENVIRONMENTAL PROTECTION AGENCY:**

Deborah Jordan, Chief
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9/19/02
Date

**FOR THE STATE OF CALIFORNIA:**

Sayareh Amir, Chief
Southern California Cleanup Operations, Glendale Office
Department of Toxic Substances Control

6/11/02
Date

Dennis A. Dickerson
Executive Officer
California Regional Water Quality Control Board
Los Angeles Region

July 12, 2002
Date

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## ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| AR | Administrative Record |
| ARAR | Applicable or Relevant and Appropriate Requirement(s) |
| ATSDR | Agency for Toxic Substances and Disease Registry |
| bgs | below ground surface |
| Cal-EPA | State of California, Environmental Protection Agency |
| CalTech | California Institute of Technology |
| $CCl_4$ | carbon tetrachloride |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act of 1980 |
| CFR | Code of Federal Regulations |
| DCE | dichloroethene |
| DTSC | Department of Toxic Substances Control |
| EPA | United States Environmental Protection Agency |
| ERA | ecological risk assessment |
| Freon™113 | 1,1,2-trichloro-1,2,2-trifluoroethane |
| FS | feasibility study |
| FWEC | Foster Wheeler Environmental Corporation |
| GAC | granular activated carbon |
| HI | hazard index |
| HHRA | human health risk assessment |
| HQ | hazard quotient |
| HSC | Health and Safety Code |
| JPL | Jet Propulsion Laboratory |
| mg/kg | milligram per kilogram |
| NA | not applicable |
| NASA | National Aeronautics and Space Administration |
| NAVFAC | Naval Facilities Engineering Command |
| NCP | National Oil and Hazardous Substances Pollution Contingency Plan |
| NEPA | National Environmental Policy Act of 1969 |
| NFA | no further action |
| NPL | National Priorities List |

| | |
|---|---|
| O&M | operation and maintenance |
| OSHA | Occupational Safety and Health Administration |
| OU | operable unit |
| PAH | polycyclic aromatic hydrocarbon |
| PCB | polychlorinated biphenyl |
| R&D | research and development |
| RAO | remedial action objective |
| RAP | remedial action plan |
| RCRA | Resource Conservation and Recovery Act |
| RI | Remedial Investigation |
| ROD | Record of Decision |
| RWQCB | Regional Water Quality Control Board |
| SARA | Superfund Amendments and Reauthorization Act of 1986 |
| SCAQMD | South Coast Air Quality Management District |
| SVE | soil vapor extraction |
| SVOC | semivolatile organic compounds |
| TCE | trichloroethene |
| TPH | total petroleum hydrocarbons |
| USC | United States Code |
| VOC | volatile organic compound |

# Part II: DECISION SUMMARY

## 1.0: SITE NAME, LOCATION, AND DESCRIPTION

| | |
|---|---|
| SITE NAME: | Jet Propulsion Laboratory (JPL) |
| EPA ID NUMBER: | CA9800013030; Federal Facility Agreement Docket Number 1998-27 |
| LOCATION: | 4800 Oak Grove, Pasadena, California |
| SITE TYPE: | Federal facility; Government owned, Contractor operated |
| LEAD AGENCY: | National Aeronautics and Space Administration (NASA) |
| SUPPORTING AGENCIES: | U.S. Environmental Protection Agency (EPA), Region IX; State of California Environmental Protection Agency (Cal-EPA), Department of Toxic Substances Control (DTSC); and California Regional Water Quality Control Board (RWQCB), Los Angeles Region |
| OPERABLE UNIT: | Operable Unit 2 (OU-2), on-facility vadose zone soil |

JPL is located within the city boundaries of La Cañada Flintridge, California; however, JPL has a Pasadena mailing address. Figure 1-1 shows the location and boundaries of the JPL site, which comprises approximately 176 acres. Federally owned land consists of approximately 156 acres, with the remaining land leased for parking from the City of Pasadena and the Flintridge Riding Club. The surrounding area is primarily residential with some light commercial operations. The site is bordered by the San Gabriel Mountains to the north, an equestrian club and Fire Station to the southwest, residential neighborhoods to the west, and the Arroyo Seco wash to the east and southeast. JPL is located in the Raymond Basin Watershed, which serves as a source of drinking water for several communities in the area. Using data from the United States Census 2000, it is estimated that approximately 44,000 people reside within 3 miles of JPL.

The Army developed and contracted with JPL between 1939 and 1958 as a research and development (R&D) laboratory for ordnance activities. On December 3, 1958, jurisdiction was transferred to NASA at which time R&D efforts at JPL began to focus on aeronautics, space technology, and space transportation. Current R&D activities at JPL also include remote sensing, robotic space exploration, astrophysics, and planetary science. In 2001, the JPL workforce consisted of approximately 5,175 employees and contractors.

NASA is the lead federal agency for selecting, implementing, and funding remedial activities at JPL, while EPA, DTSC, and RWQCB provide oversight and technical assistance.

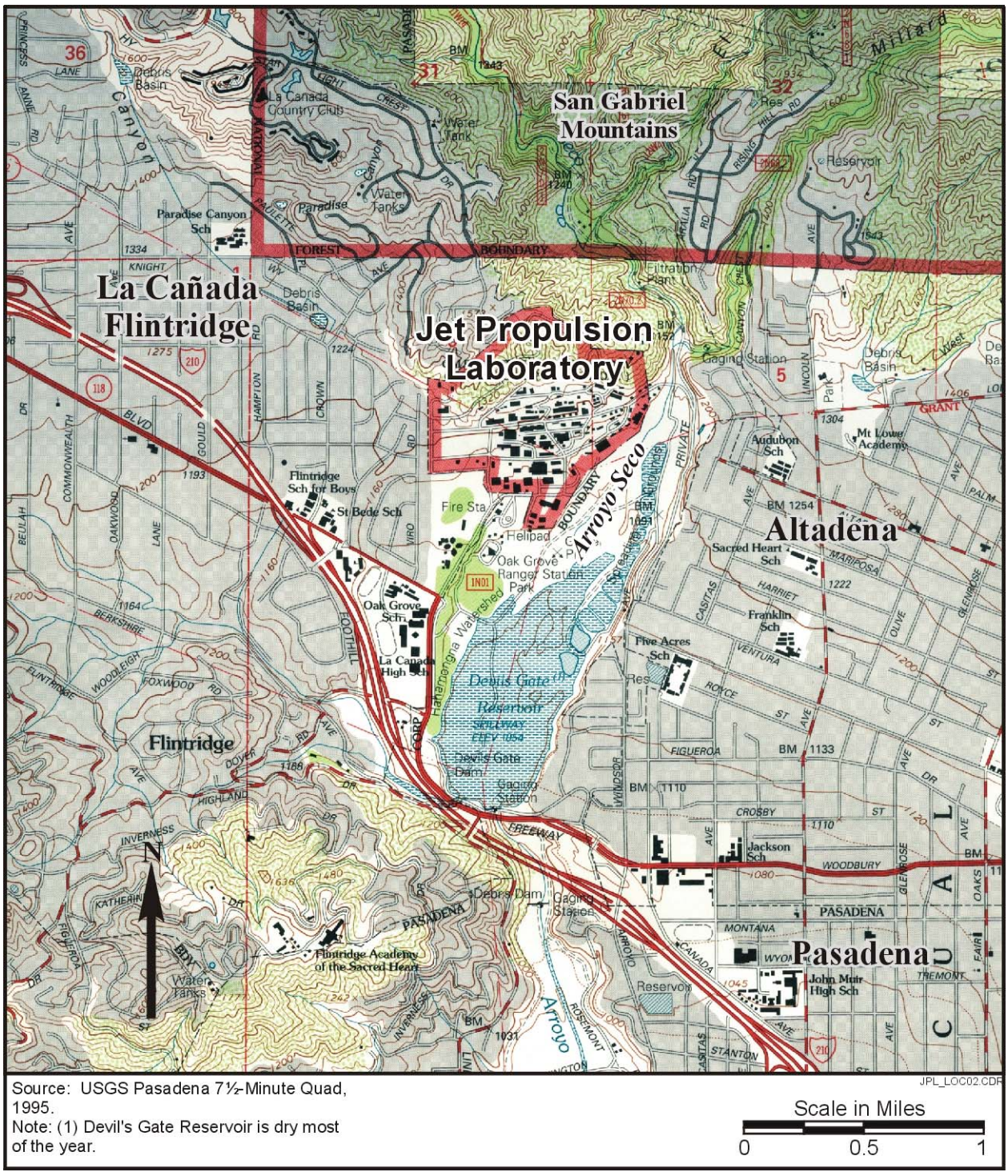


**Figure 1-1. Map of JPL and the Surrounding Area**

## 2.0: SITE ASSESSMENT AND CHARACTERIZATION

During historic operations at JPL, various chemicals (including chlorinated solvents, solid rocket fuel propellants, cooling tower chemicals, sulfuric acid, Freon™, and mercury) and other materials were used at the site. During the 1940s and 1950s, many buildings at JPL maintained subsurface seepage pits for disposal of sanitary wastes and laboratory chemical wastes collected from drains and sinks within the buildings. The Remedial Investigation (RI) identified 40 seepage pits, 5 waste pits, and 4 discharge points at the site that were used during historic operations (Foster Wheeler Environmental Corporation [FWEC], 1999a). Some of the seepage pits received volatile organic compounds (VOCs) and other waste materials that are currently found in vadose zone soil and soil vapor beneath JPL. In the late 1950s and early 1960s, a sanitary sewer system was installed at JPL to handle sewage and wastewater, and the use of seepage pits for sanitary and chemical waste disposal was discontinued. Today, laboratory chemical wastes are either recycled or sent off-site for treatment and disposal at regulated, Resource Conservation and Recovery Act (RCRA)-permitted hazardous waste facilities.

In 1980, the analyses of groundwater revealed the presence of VOCs in City of Pasadena water-supply wells located southeast of JPL in the Arroyo Seco. At about the same time, VOCs were detected in two water-supply wells used by the Lincoln Avenue Water Company, located east of the Arroyo Seco (FWEC, 1999a). In 1988, a Preliminary Assessment/Site Inspection was completed at JPL, which indicated that further site characterization was warranted (Ebasco, 1988a and 1988b). Subsequent site investigations were conducted at JPL (Ebasco, 1990a and 1990b) and VOCs were detected in on-facility groundwater at levels above drinking water standards. In 1992, JPL was placed on the National Priorities List (NPL) of sites subject to regulation under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (47189-47187 *Federal Register*, 1992, Vol. 57, No. 199).

After being placed on the NPL, potential source areas were investigated at OU-2 during the RI, which lasted from 1994 to 1998 (FWEC, 1999a). Both soil samples and soil vapor samples were collected during the RI. Soil samples were analyzed for metals, semivolatile organic compounds (SVOCs), polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), dioxins, furans, and total petroleum hydrocarbons (TPH). Near-surface soils were also analyzed for VOCs. Soil vapor samples were analyzed for VOCs. Detailed discussions of investigations related to soil and soil vapor at JPL are contained in the RI/Feasibility Study (FS) Work Plan (Ebasco, 1993) and in the RI report (FWEC, 1999a).

The RI was followed by the FS (FEWC, 2000), which involved risk evaluation, data interpretation, and conducting a soil vapor extraction (SVE) pilot test. The SVE pilot test was used to determine the feasibility of SVE for remediating VOCs in soil beneath JPL. The pilot test involved the installation of one SVE well and the use of granular activated carbon for vapor treatment. Twelve vapor monitoring points were used to assess vacuum responses and collect soil vapor samples to determine the effectiveness of the SVE pilot test. Detailed results of the SVE pilot-scale test are presented in the FS (FEWC, 2000). Over 200 pounds (lbs) of VOCs were removed during the pilot test.

## 3.0: COMMUNITY PARTICIPATION

The communities surrounding JPL have been informed about the progress of environmental programs at JPL. The methods used by NASA to ensure that communities are properly informed and included in the CERCLA process are described in the *Superfund Community Relations Plan* (NASA, 1994).

The RI report (FWEC, 1999a), FS (FWEC, 2000), and other documentation for OU-2 at NASA JPL were made available to the public via the Administrative Record maintained at JPL and the information repositories maintained at the JPL Library, Altadena Public Library, the La Cañada Flintridge Public Library, and the Pasadena Central Library. The index to the Administrative Record for OU-2 is included in Appendix B.

The Proposed Plan (NASA, 2001) was prepared and mailed on May 9, 2001 to 4,759 residences, businesses, and organizations in Altadena, La Cañada Flintridge, and Pasadena. Three public meetings were then held to present the Proposed Plan to the public. Two were held at JPL on May 12 and 14, 2001 and one was held on June 20, 2001 at the Eliot Middle School in Altadena, California. The public comment period was open from May 7 through July 11, 2001.

Public notifications of the May 12 and 14, 2001 meetings were included in the Proposed Plan and newspaper announcements. In addition, on May 1, 2001, notification of the Proposed Plan and public meeting was e-mailed to approximately 5,000 JPL employees. Public notification of the meeting on June 20 was provided through a mailer sent on May 30, KPCC radio announcements on June 18 and 19, and newspaper notices. The newspaper notices appeared in local newspapers, as listed in Table 3-1. The text of these public notices is included in Appendix C.

**Table 3-1. Summary of Newspaper Meeting Announcements**

| Newspaper | May 12 and 14, 2001 Meeting Announcements | June 20, 2001 Meeting Announcements |
|---|---|---|
| *Foothill Leader* | April 28;<br>May 5, 12 | NA |
| *Pasadena Star-News* | May 7 to 11 | June 9 to 15 |
| *Glendale News-Press* | April 28; May 5,<br>May 7 to 11 | June 6, 9, 13, and 16 |
| *La Cañada Sun* | May 10 | June 7 and June 14 |
| *Los Angeles Times* | May 11 | NA |

NA = not applicable.

Copies of the public meeting transcripts are included in Appendix D. NASA's responses to the comments received during the public comment period are included in the Responsiveness Summary, Part III of this Record of Decision (ROD). Also, copies of the Responsiveness Summary were mailed to each community member present at the June 20 public meeting, if a mailing address was provided.

# 4.0: SCOPE AND ROLE OF OPERABLE UNIT 2

This ROD addresses OU-2, which comprises the vadose zone soil located at JPL. The vadose zone is the region located between the ground surface and the water table. Results from the RI showed that chemicals are currently found within the vadose zone beneath JPL, but that the vadose zone soils located adjacent to the JPL property have not been adversely impacted by chemicals from JPL.

NASA's cleanup plan for JPL includes concurrently addressing remediation of soil and groundwater. The potential remedies for the groundwater are still being evaluated at this time and will be addressed in a separate decision document. However, the use of soil vapor extraction at OU-2 may enhance the overall site cleanup strategy by removing VOCs from the vadose zone, thus reducing the source of VOCs that may migrate to the groundwater.

# 5.0: SITE CHARACTERISTICS (OPERABLE UNIT 2)

## 5.1 JPL and Operable Unit 2 Area Setting

A description of the area setting of JPL OU-2, including a detailed discussion of the regional demographics, climate, physiography, geology, hydrology, hydrogeology, natural resources, and cultural resources can be found in the National Environmental Policy Act of 1969 (NEPA) Values Assessment, which is provided in Appendix E.

## 5.2 Sources, Nature, and Extent of Chemicals in Soil at JPL

Various seepage pits and other areas were identified at JPL as possible locations used for chemical waste disposal during historic operations (as shown in Figure 5-1). The nature and extent of VOCs in vadose zone soil was determined through both soil vapor surveys and soil sampling conducted at the site during the RI. More detailed information on the sampling strategy can be found in the RI report (FWEC, 1999a).

### *5.2.1 Soil Vapor Sampling Results*

During the RI and periodic soil vapor monitoring, four VOCs were frequently detected in soil vapor samples at elevated concentrations. These four VOCs are carbon tetrachloride ($CCl_4$), 1,1,2-trichloro-1,2,2-trifluoroethane (Freon™113), trichloroethene (TCE), and 1,1-dichloroethene (DCE). The estimated horizontal and vertical extent of VOCs in soil vapor is shown in Figures 5-2 and 5-3. More detailed information on the analytical results from soil vapor sampling is included in the RI report (FWEC, 1999a).

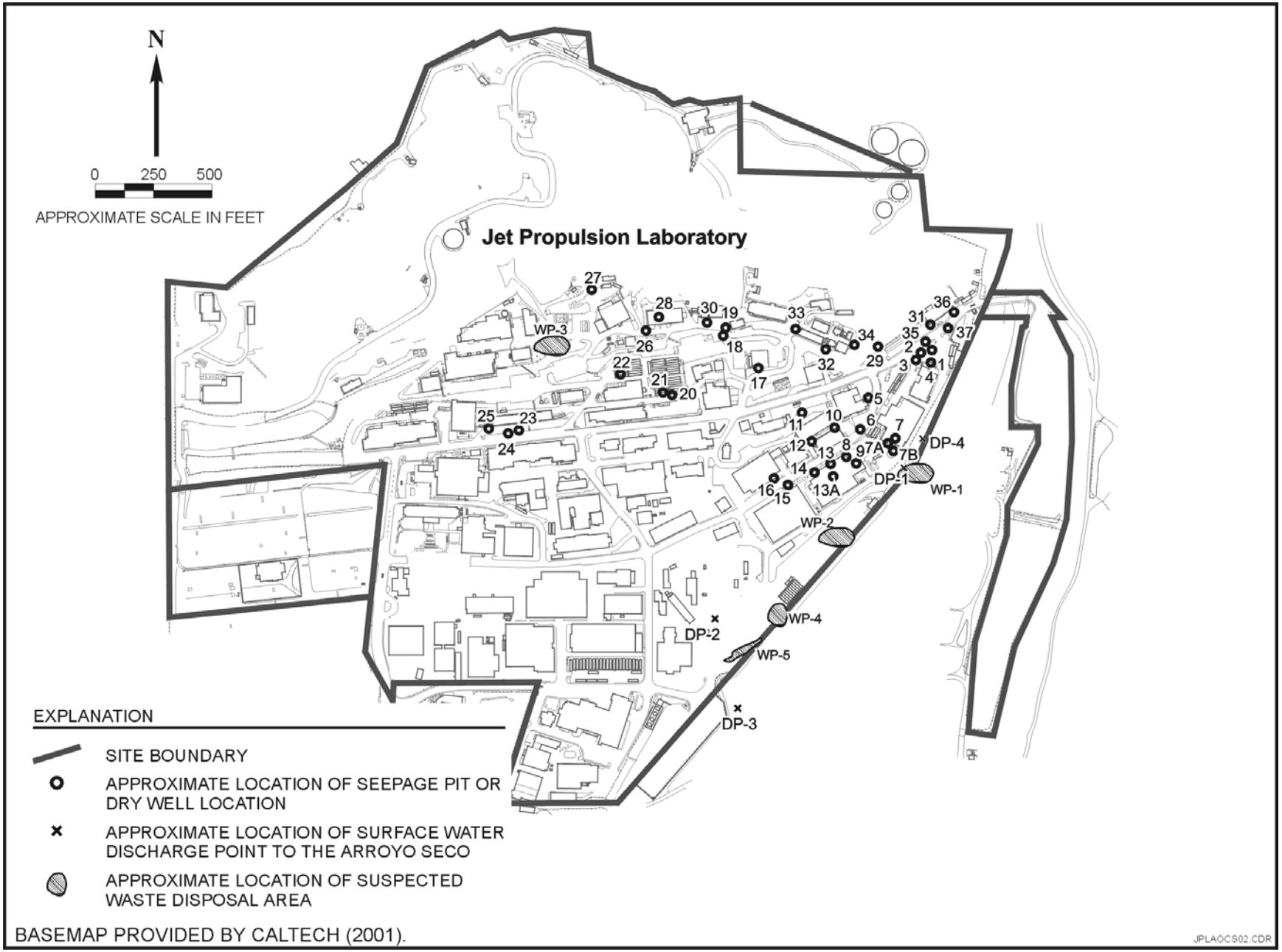


**Figure 5-1. Potential Historic Chemical Waste Disposal Locations**

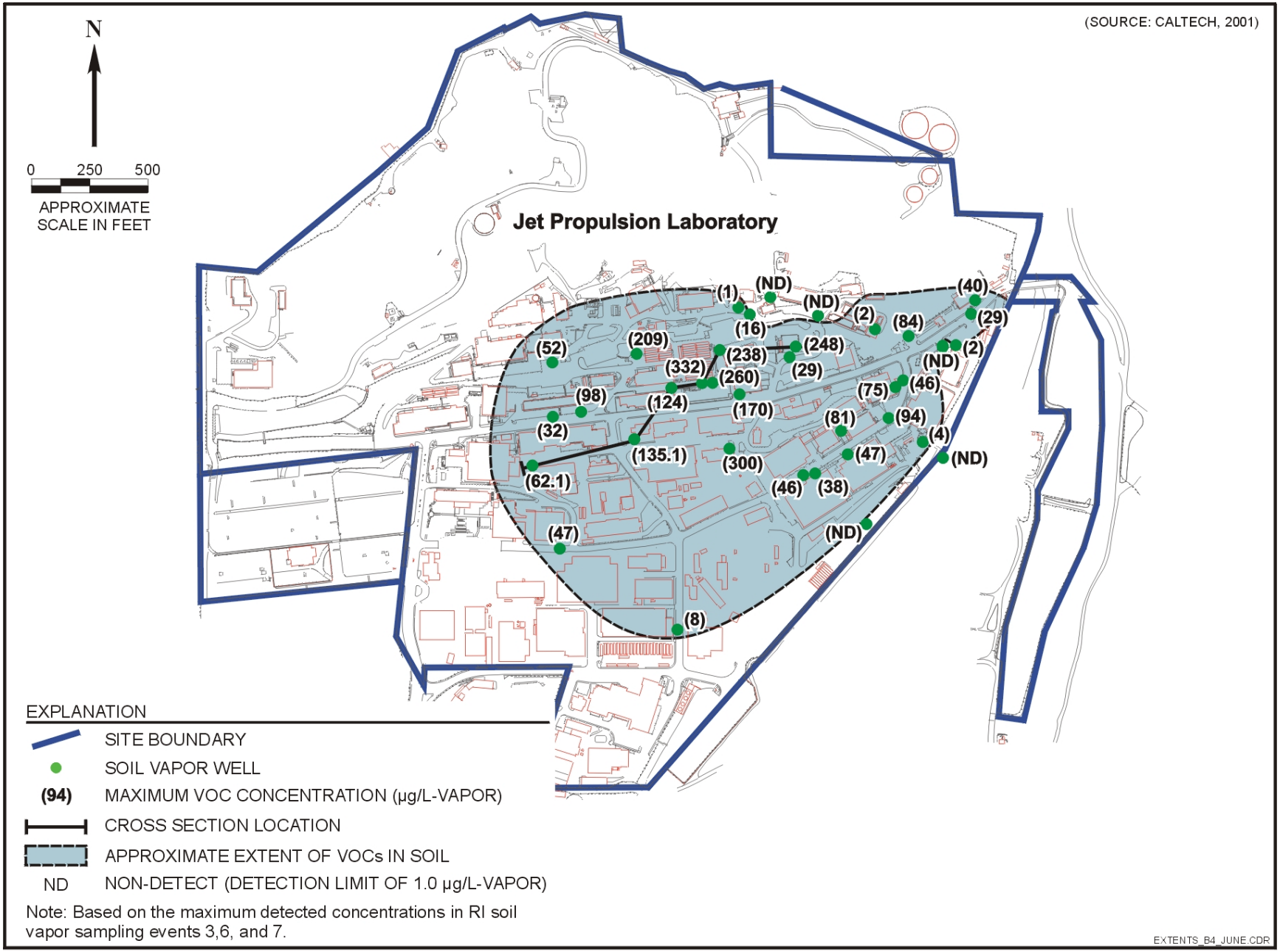


**Figure 5-2. Plan View of VOC Soil Vapor Plume (May-June 1998)**